

**LECTURE NOTES**

**ON**

**Microprocessors**

**(ECE – S304)**

**Department of Electronics & Communication Engineering**

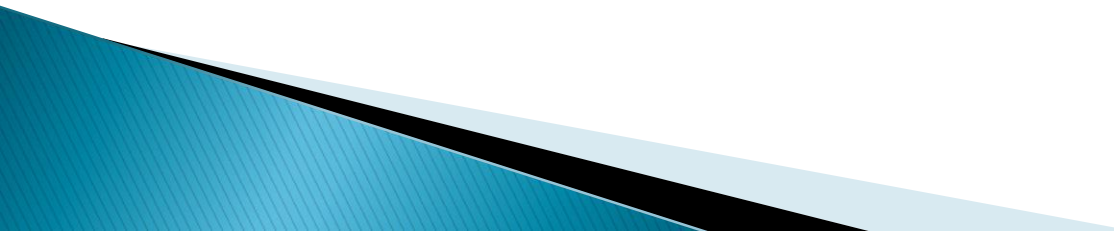
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## Evolution of Microprocessors

The Microprocessor is nothing but the CPU and it is an essential component of the computer. It is a **silicon chip** that comprises millions of **transistors** and other **electronic components** that process millions of instructions per second. A **Microprocessor is a versatile chip**, that is combined with memory and special-purpose chips and pre-programmed by software. It accepts digital data as i/p and processes it according to the instructions stored in the memory. The microprocessor has many functions like functions of data storage, interact with various other devices, and other time-related functions. But, the main function is to send and receive the data to make the function of the computer well.



# Evolution of Microprocessors

- Transistor was invented in 1948.
- IC was invented in 1958.
- First Microprocessor was invented by INTEL.

## First Generation Microprocessors

The first generation microprocessors were introduced in the year 1971-1972. The instructions of these microprocessors were processed serially, they fetched the instruction, decoded and then executed it. When an instruction of the microprocessor was finished, then the microprocessor updates the instruction pointer & fetched the following instruction, performing this consecutive operation for each instruction in turn.

# Second Generation Microprocessors

In the year 1970, a small number of transistors were available on the integrated circuit in the second-generation microprocessors. These processors are introduced in the year 1979, and Intel 8080 processor is another example of the microprocessor. The second generation of the microprocessor is defined by overlapped fetch, decode, and execute the steps.

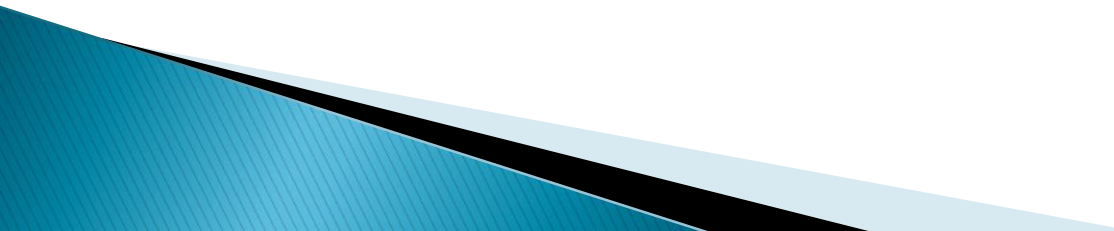
The difference between the first generation microprocessor and second-generation microprocessors was mainly the use of new semiconductor technologies to manufacture the chips. The result of this technology resulted in a fivefold increase in instruction, speed, execution, and higher chip densities.

## Third Generation Microprocessors

The third generation microprocessors were introduced in the year 1978, as denoted by Intel's 8086 and the Zilog Z8000. These were 16-bit processors with a performance like mini computers. These types of microprocessors were different from the previous generations of microprocessors.

## Fourth Generation Microprocessors

As many industries converted from commercial microprocessors to in house designs, the fourth generation microprocessors are entered with outstanding design with a million transistors. Leading-edge microprocessors like Motorola's 88100 and Intel's 80960CA could issue & retire more than one instruction per clock cycle.



# Fifth Generation Microprocessors

Fifth-generation microprocessors employed decoupled superscalar processing, and their design soon exceeded 10 million transistors. In the fifth generation, PCs are a low-margin, high volume business conquered by a single microprocessor.

## Types of Microprocessors

### ▶ 4-bit Microprocessor

The INTEL 4004/4040 was invented in the year 1971 by Stanley Mazor & Ted Hoff. The clock speed of this microprocessor is 740 KHz. The number of transistors used in this microprocessor is 2,300 and instruction per second is 60K. The number of pins of this microprocessor is 16.

## ▶ 8-bit Microprocessor

- i) The 8008 processor was invented in the year 1972. The clock speed of this microprocessor is 500 KHz and instruction per second is 50K
- ii) The 8080 microprocessor was invented in the year 1974. The clock speed is 2 MHz. The number of transistors used is 60k and instruction per second is 10 times quicker as compared with 8008 processor.
- iii) The 8085 microprocessor was invented in the year 1976. The clock speed is 3 MHz. The number of transistors used is 6,500 and instruction per second is 769230. The number of pins of this microprocessor is 40.

## ➤ 16-bit Microprocessor

The 8086 microprocessor was invented in the year 1978. The clock speed is 4.77, 8 & 10 MHz. The number of transistors used is 29000 and instruction per second is 2.5 Million. The number of pins of this microprocessor is 40

The 8088 microprocessor was invented in the year 1979 and instruction per second is 2.5 Million

The microprocessors like 80186 or 80188 were invented in the year 1982. The clock speed is 6 MHz

The 80286 microprocessor was invented in the year 1982. The clock speed is 8 MHz. The number of transistors used is 134000 and instruction per second is 4 Million. The number of pins of this microprocessor is 68



## ➤ 32-bit Microprocessor

- ▶ The Intel 80386 microprocessor was invented in the year 1986. The clock speed is 16 MHz to 33 MHz. The number of transistors used is 275000. The number of pins of this microprocessor is 132 14X14 PGA.
- ▶ The Intel 80486 microprocessor was invented in the year 1986. The clock speed is 16MHz to 100 MHz. The number of transistors used is 1.2 Million transistors and instruction per second is 8 KB of cache memory. The number of pins of this microprocessor is 168 17X17 PGA (Pin Grid Array).
- ▶ The PENTIUM microprocessor was invented in the year 1993. The clock speed is 66 MHz and instruction per second is Cache memory 8-bit for instructions 8- bit for data. The number of pins of this microprocessor is 237 PGA.

## ➤ 64-bit Microprocessor

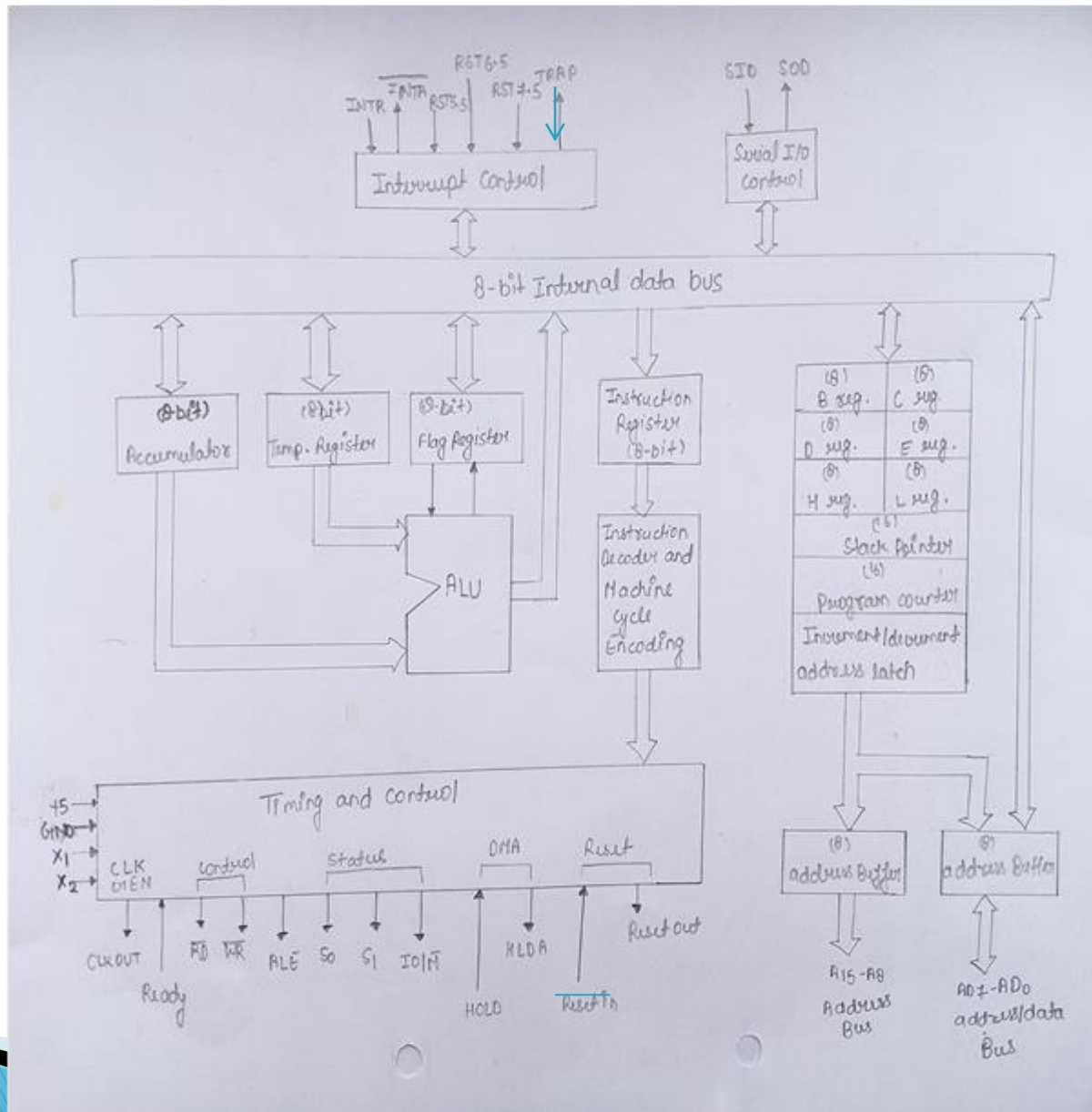
- ▶ The INTEL core 2 microprocessor was invented in the year 2006. The clock speed is 1.2 GHz to 3 GHz. The number of transistors used is 291 Million and instruction per second is 64 KB of L1 cache for each core 4 MB of L2 cache.
- ▶ The i3, i5, i7 microprocessors were invented in the years 2007, 2009, 2010. The clock speed is 2GHz to 3.3GHz, 2.4GHz to 3.6GHz & 2.93GHz to 3.33GHz.

# MICROPROCESSOR-8085

## FEATURES

- It is a 40 pin IC.
- It is an 8-bit processor.
- 8-bit Data bus ie;  $D_0 - D_7$ .
- 16-bit Address bus ie;  $A_0 - A_{15}$ .
- Operating CLK Freq around 3 MHz.
- Maximum memory that can be interfaced with 8085 is 64 KB.

# Functional Block Diagram



# Architecture of Microprocessor – 8085

The Architecture of Processor 8085 is Block wise. The description of various Blocks are as follows –

## ➤ ALU (Arithmetic Logic Unit)

All the arithmetic and logical operations are performed in this unit. Such as addition, subtraction, compliments, ANDing, ORing, X-ORing etc.

## ➤ Accumulator

- It is an 8-bit register.
- During the arithmetic or logic operations one of the operand comes from the accumulator.
- The result of the arithmetic or logic operations is also stored in the accumulator.

## ➤ Temporary Register

- W, X and Z are the temporary registers of 8085.
- Capacity of each register is 8-bit.
- These registers are used by microprocessor itself for interface operations.

## ➤ Flag Register

- It is an 8- bit register but only five bits are used.
- It is also called Program Status Word (PSW).



### Program Status Word

- **S** → Sine Flag
- **Z** → Zero Flag
- **AC** → Auxiliary Carry Flag
- **P** → Parity Flag
- **CY** → Carry Flag.